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# Reducing mortality from childhood pneumonia and diarrhoea:

# The leading priority is also the greatest opportunity

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Pneumonia and diarrhoea have been the leading causes of global child mortality for many decades. The work of Child Health Epidemiology Reference Group (CHERG) has been pivotal in raising awareness that the UN's Millennium Development Goal 4 cannot be achieved without increased focus on preventing and treating the two diseases in low- and middle-income countries. Global Action Plan for Pneumonia (GAPP) and Diarrhoea Global Action Plan (DGAP) groups recently concluded that addressing childhood pneumonia and diarrhoea is not only the leading priority but also the greatest opportunity in global health today: scaling up of existing highly cost-effective interventions could prevent 95% of diarrhoea deaths and 67% of pneumonia deaths in children younger than 5 years by the year 2025. The cost of such effort was estimated at about US\$ 6.7 billion.

Pneumonia and diarrhoea have been the leading causes of global child mortality for many decades [1]. Their relative importance in comparison to other causes of child deaths, such as malaria, preterm birth, birth asphyxia, accidents, neonatal infections and cancer, has become fully appreciated in 2003 through the work of the World Health Organization's and UNICEF's Child Health Epidemiology Reference Group (CHERG) [2]. The "Child Survival" series, published by *The Lancet*, has been pivotal in raising awareness that the UN's Millennium Development Goal 4 cannot be achieved without increased focus on preventing and treating childhood infections – particularly pneumonia and diarrhoea – in low- and middle-income countries [3]. The next big step involved the "Global Action Plan for Pneumonia" (GAPP), which summarized the evidence on the epidemiology of acute lower respiratory infections in children, the key etiological agents, the main determinants of the disease, the available and emerging solutions and the main obstacles to their implementation [4]. GAPP's landmark publication in 2008 showed that there are about 156 million new cases of pneumonia each year, and that about one in ten results in a severe episode that requires

hospitalization, and a further 10% of severe episodes lead to deaths of affected children [5]. The paper also proposed that *Streptococcus pneumoniae* (SP), *Haemophilus influenzae* type B (Hib), respiratory syncytial virus (RSV) and influenza virus are the pathogens whose interplay is the most likely cause of the large majority of pneumonia deaths in children under five years of age [5]. This led to increased attention to pneumonia prevention through available vaccines against PC, Hib and influenza virus, to complement existing (antibiotic) case management strategies, including those delivered by community health workers. The underdeveloped and weak health systems in low-resource settings, where most deaths occur, cannot easily scale up antibiotic coverage to children who need them most, because of relatively low rates of access to health care [6]. Another obstacle to progress is infrequent care-seeking among parents who did not receive adequate education on this important health issue [6].

Four papers that followed the GAPP initiative, all of them published by *The Lancet*, have estimated the global and regional burden of SP [7], Hib [8], RSV [9] and influenza [10]. In parallel to understanding the burden of specific

pathogens, new financial mechanisms have been developed – such as the Advance Market Commitment (AMC) – to reduce the prices of available vaccines and deliver them in low- and middle-income countries, where they would otherwise remain unaffordable to local governments [11]. The Global Alliance for Vaccines and Immunization (now called the GAVI Alliance) has been set up to raise funding to purchase these vaccines, with major contributions from the Bill and Melinda Gates Foundation who stood firmly behind the initiative to vaccinate children and prevent respiratory infections [12]. Those efforts ensured that most children in low-resource settings have received Hib vaccination by 2010, and pneumococcal vaccination coverage is also now being scaled up globally [13].

The similar effort for diarrhoea has been lagging behind until recently, when an international collaboration of researchers launched a “Diarrhoea Global Action Plan” (DGAP) [14]. Under the co-ordination of UNICEF, the World Health Organization, and USAID, the initiative has been merged with GAPP into “GAPPD” – “Global Action Plan for Pneumonia and Diarrhoea” [15]. This was a welcome move, because many risk factors are shared between the two diseases, and many approaches to control them could be delivered in parallel through an Integrated Management of Childhood Illness (IMCI) approach. Communities of researchers and policy-makers who are focused on diarrhoea control have also recently acquired the first vaccine effective in preventing an appreciable portion of the burden – rotavirus vaccine [16]. This vaccine will be added to GAVI portfolio to supplement PC and Hib vaccines for pneumonia [17].

The GAPPD group has recently been invited by The Lancet to write a series of papers that jointly address the epidemiology of childhood diarrhoea and pneumonia, the available cost-effective interventions, country-specific challenges and bottlenecks, and suggest policies that could accelerate progress in reduction of global mortality from the two diseases [15,18,19]. The series proposed that scaling up of existing highly cost-effective interventions could prevent 95% of diarrhoea deaths and 67% of pneumonia deaths in children younger than 5 years by the year 2025, if delivered at scale. The cost of this effort was estimated at about US\$ 6.7 billion [15,18,19]. These activities, along with increased political stability in many low- and middle-income countries, their economic development, improved sanitation and access to care, progress in empowering and educating women in the society and strengthening health systems, could all contribute to very substantial reduction of the global burden of child mortality attributable to pneumonia and diarrhoea [18,20,21]. We should, therefore,

conclude that addressing childhood pneumonia and diarrhoea is not only the leading priority, but also possibly the greatest opportunity in global health today.

There is a growing consensus that an improved understanding of the size of the burden, the leading risk factors and the relative contribution of the leading etiological causes; the available vaccines and other cost-effective interventions, such as community case management with antibiotics, oral rehydration sachets and zinc supplementation; and the momentum that many low- and middle-income countries have gathered in improving their economic outlook, have all provided the international health community with an unprecedented opportunity to substantially reduce the mortality from childhood pneumonia globally over the period of the next decade [15].

To support those ongoing initiatives, several leading medical journals published special issues, or series of articles, focused on childhood diarrhoea and pneumonia (and child survival in general) in the first half of 2013. As noted above, *The Lancet* will publish a four-paper series on childhood diarrhoea and pneumonia in April 2013, which is likely to have very large impact on the field [15,18,19]. *PLoS Medicine* published a PLoS Medicine Collection on improving intervention delivery progress tracking and information systems in low-resource settings that could guide policy decisions. BMC Public Health is expected to publish a series of reviews that will present results of meta-analyses of the effectiveness of several key child health interventions, such as breastfeeding and vaccination, which should further strengthen the evidence base for the Lives Saved Tool (LiST) [22]. In this issue, *Journal of Global Health* joins this coordinated international effort launched by the CHERG group. We are bringing together several articles that should fill the remaining gaps in understanding acute respiratory infections and diarrhoeal disease in children. Rudan et al. revise national-level estimates of the morbidity, severe morbidity, mortality, etiology and risk factors for acute lower respiratory infections for 2010 [23]. Fischer-Walker et al. provide an assessment of co-morbidity between childhood pneumonia and diarrhoea [24]. Zwisler et al. use surveys to study the perception and use of oral rehydration sachets, antibiotics, and other therapies for diarrhoea in India and Kenya [25]; Wilson et al. analyse scaling up access to oral rehydration solution for diarrhea, learning from historical experience in low- and high-performing countries [26]; Simpson et al. add to this work by surveying caregivers in Kenya to assess perceptions of zinc as a treatment for diarrhea [27]. Finally, Zipursky et al. report on the global action plan for childhood diarrhea and show how research priorities were developed within this effort [14].

- 1 Rudan I, Theodoratou E, Zgaga L, Nair H, Chan KY, Tomlinson M, et al. Setting priorities for development of emerging interventions against childhood pneumonia, meningitis and influenza. *J Glob Health*. 2012;2:010304. [Medline:23198129](#) [doi:10.7189/jogh.01.010304](#)
- 2 Black RE, Morris SS, Bryce J. Where and why are 10 million children dying every year? *Lancet*. 2003;361:2226-34. [Medline:12842379](#) [doi:10.1016/S0140-6736\(03\)13779-8](#)
- 3 Rudan I, Tomaskovic L, Boschi-Pinto C, Campbell H; WHO Child Health Epidemiology Reference Group. Global estimate of the incidence of clinical pneumonia among children under five years of age. *Bull World Health Organ*. 2004;82:895-903. [Medline:15654403](#)
- 4 Greenwood B. A global action plan for the prevention and control of pneumonia. *Bull World Health Organ*. 2008;86:322-2A. [Medline:18545727](#) [doi:10.2471/BLT.08.053348](#)
- 5 Rudan I, Boschi-Pinto C, Biloglav Z, Mulholland K, Campbell H. Epidemiology and etiology of childhood pneumonia. *Bull World Health Organ*. 2008;86:408-16. [Medline:18545744](#) [doi:10.2471/BLT.07.048769](#)
- 6 Rudan I, El Arifeen S, Bhutta ZA, Black RE, Brooks A, Chan KY, et al; WHO/CHNRI Expert Group on Childhood Pneumonia. Setting research priorities to reduce global mortality from childhood pneumonia by 2015. *PLoS Med*. 2011;8:e1001099. [Medline:21980266](#) [doi:10.1371/journal.pmed.1001099](#)
- 7 O'Brien KL, Wolfson LJ, Watt JP, Henkle E, Deloria-Knoll M, McCall N; Hib and Pneumococcal Global Burden of Disease Study Team. Burden of disease caused by *Streptococcus pneumoniae* in children younger than 5 years: global estimates. *Lancet*. 2009;374:893-902. [Medline:19748398](#) [doi:10.1016/S0140-6736\(09\)61204-6](#)
- 8 Watt JP, Wolfson LJ, O'Brien KL, Henkle E, Deloria-Knoll M, McCall N, et al; Hib and Pneumococcal Global Burden of Disease Study Team. Burden of disease caused by *Haemophilus influenzae* type b in children younger than 5 years: global estimates. *Lancet*. 2009;374:903-11. [Medline:19748399](#) [doi:10.1016/S0140-6736\(09\)61203-4](#)
- 9 Nair H, Nokes DJ, Gessner BD, Dherani M, Madhi SA, Singleton RJ, et al. Global burden of acute lower respiratory infections due to respiratory syncytial virus in young children: a systematic review and meta-analysis. *Lancet*. 2010;375:1545-55. [Medline:20399493](#) [doi:10.1016/S0140-6736\(10\)60206-1](#)
- 10 Nair H, Brooks WA, Katz M, Roca A, Berkley JA, Madhi SA, et al. Global burden of respiratory infections due to seasonal influenza in young children: a systematic review and meta-analysis. *Lancet*. 2011;378:1917-30. [Medline:22078723](#) [doi:10.1016/S0140-6736\(11\)61051-9](#)
- 11 Cernuschi T, Furrer E, Schwalbe N, Jones A, Berndt ER, McAdams S. Advance market commitment for pneumococcal vaccines: putting theory into practice. *Bull World Health Organ*. 2011;89:913-8. [Medline:22271949](#) [doi:10.2471/BLT.11.087700](#)
- 12 Nossal GJ. Gates, GAVI, the glorious global funds and more: all you ever wanted to know. *Immunol Cell Biol*. 2003;81:20-2. [Medline:12534942](#) [doi:10.1046/j.0818-9641.2002.01139.x](#)
- 13 Countdown Coverage Writing Group; Countdown to 2015 Core Group, Bryce J, Daelmans B, Dwivedi A, Fauveau V, Lawn JE, Mason E, et al. Countdown to 2015 for maternal, newborn, and child survival: the 2008 report on tracking coverage of interventions. *Lancet*. 2008;371:1247-58. [Medline:18406859](#) [doi:10.1016/S0140-6736\(08\)60559-0](#)
- 14 Zipursky A, Wazny K, Black RE, Keenan W, Duggan C, Olness K, et al. Global action plan for childhood diarrhea: developing research priorities. *J Glob Health*. 2013;3:010406. [doi:10.7189/jogh.03.010406](#)
- 15 Chopra M, Mason E, Borrazzo J, Campbell H, Rudan I, Liu L, et al. Ending of preventable deaths from pneumonia and diarrhoea: an achievable goal. *Lancet*. 2013;381:1499-506. [Medline:23582723](#) [doi:10.1016/S0140-6736\(13\)60648-0](#)
- 16 Madhi SA, Cunliffe NA, Steele D, Witte D, Kirsten M, Louw C, et al. Effect of human rotavirus vaccine on severe diarrhea in African infants. *N Engl J Med*. 2010;362:289-98. [Medline:20107214](#) [doi:10.1056/NEJMoa0904797](#)
- 17 Bhan A, Green SK. Balancing safety, efficacy and cost: Improving rotavirus vaccine adoption in low- and middle-income countries. *J Glob Health*. 2011;1:148-53. [Medline:23198115](#)
- 18 Fischer Walker CL, Rudan I, Liu L, Nair H, Theodoratou E, Bhutta ZA, et al. Global burden of childhood diarrhoea and pneumonia. *Lancet*. 2013;381:1405-16. [Medline:23582727](#) [doi:10.1016/S0140-6736\(13\)60222-6](#)
- 19 Bhutta ZA, Das JK, Walker N, Rizvi A, Campbell H, Rudan I, et al. Interventions to address deaths from childhood diarrhoea and pneumonia equitably: what works and at what cost? *Lancet*. 2013;381:1417-29. [Medline:23582723](#) [doi:10.1016/S0140-6736\(13\)6048-0](#)
- 20 Feng XL, Theodoratou E, Liu L, Chan KY, Hipgrave D, Scherpbier R, et al. Social, economic, political and health system and program determinants of child mortality reduction in China between 1990 and 2006: A systematic analysis. *J Glob Health*. 2012;2:010405. [Medline:23198134](#) [doi:10.7189/jogh.02.010405](#)
- 21 Liu L, Johnson HL, Cousens S, Perin J, Scott S, Lawn JE, et al; Child Health Epidemiology Reference Group of WHO and UNICEF. Global, regional, and national causes of child mortality: an updated systematic analysis for 2010 with time trends since 2000. *Lancet*. 2012;379:2151-61. [Medline:22579125](#) [doi:10.1016/S0140-6736\(12\)60560-1](#)
- 22 Fischer Walker CL, Friberg IK, Binkin N, Young M, Walker N, Fontaine O, et al. Scaling up diarrhea prevention and treatment interventions: a Lives Saved Tool analysis. *PLoS Med*. 2011;8:e1000428. [Medline:21445330](#) [doi:10.1371/journal.pmed.1000428](#)

- 23 Rudan I, O'Brien KL, Nair H, Theodoratou E, Liu L, Qazi S, et al. Epidemiology and etiology of childhood pneumonia in 2010: estimates of incidence, severe morbidity, mortality, underlying risk factors and causing pathogens for 192 countries. *J Glob Health*. 2013;3:010401. doi:10.7189/jogh.03.010401
- 24 Fischer Walker CL, Perin J, Katz J, Tielsch JM, Black RE. Diarrhea as a risk factor for acute lower respiratory tract infections among young children in low income settings. *J Glob Health*. 2013;3:010402. doi:10.7189/jogh.03.010402
- 25 Zwisler G, Simpson E, Moodley M. Treatment of diarrhea in young children: results from surveys on the perception and use of ORS, antibiotics, and other therapies in India and Kenya. *J Glob Health*. 2013;3:010403. doi:10.7189/jogh.03.010403
- 26 Wilson SE, Morris SS, Gilbert SS, Mosites E, Hackleman R, Weum KLM, et al. Scaling up access to oral rehydration solution for diarrhea: Learning from historical experience in low- and high-performing countries. *J Glob Health*. 2013;3:010404. doi:10.7189/jogh.03.010404
- 27 Simpson E, Zwisler G, Moodley M. A survey of caregivers in Kenya to assess perceptions of zinc as a treatment for diarrhea in young children and adherence to recommended treatment behaviors. *J Glob Health*. 2013;3:010405. doi:10.7189/jogh.03.010405

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**CORRECTION**

George-Carey R, Adeloje A, Chan KY, Paul A, Kolcic I, Campbell H, Rudan I. An estimate of the prevalence of dementia in Africa: A systematic analysis. *J Glob Health* 2013;2:020401corr1. doi:10.7189/jogh.02.020401corr1

The authors informed the publisher that the term Democratic Republic of Congo (capital: Kinshasa) was used instead of the correct name of the country – Republic of Congo (capital: Brazzaville) in Figure 2, Tables 2 and 3 and the text. The author and the publisher apologise for this error. We have since corrected the online version of the article.

See the original article: George-Carey et al, 2012.